Epitomes
Important Advances in Clinical Medicine

Nuclear Medicine

The Scientific Board of the California Medical Association presents the following inventory of items of progress in nuclear medicine. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist busy practitioners, students, research workers, or scholars to stay abreast of these items of progress in nuclear medicine that have recently achieved a substantial degree of authoritative acceptance, whether in their own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Nuclear Medicine of the California Medical Association, and the summaries were prepared under its direction.

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Single-Photon-Emission Computed Tomographic Imaging of the Bone

THE PLANAR BONE SCAN is a sensitive test that can show altered bone physiology before it is visible by other radiographic techniques. It is not always possible, however, to determine the cause of abnormal uptake on a scintigram; therefore, specificity is low. This occurs because the images depict metabolic or blood flow alteration in bone that may be due to a variety of conditions. In addition, the planar image represents a two-dimensional summation of all the counts within a three-dimensional field of view. This results in decreased contrast between the lesion and normal tissue and in the "stacking" of bony structures on top of one another.

The application of computed tomography in nuclear medicine has been helpful in overcoming these limitations, whether imaging the skeleton or other organ systems. Instead of imaging along an anatomic plane, data are acquired every 2 to 6 degrees as the camera rotates 180 to 360 degrees around the region of interest. Computer reconstruction produces a three-dimensional image that can be sliced less than 1 cm thick along the transverse, sagittal, or coronal planes. The resulting image contains only the uptake within a particular tomographic plane of interest, thus improving contrast and anatomic localization. Single-photon-emission computed tomographic (SPECT) imaging of the myocardium has improved vessel localization in coronary artery disease, and functional brain imaging has become clinically useful now that the brain can be "sliced" to expose the region(s) of decreased perfusion.

To determine the effectiveness of SPECT over planar imaging in evaluating lower back pain, 100 consecutive patients were studied: 69 abnormalities were detected by planar imaging in 57 patients, and 90 abnormalities were detected by SPECT. None of the abnormalities noted on planar were missed by SPECT, and lesions with low-grade uptake were better visualized by the latter technique.

Compared with plain radiography, SPECT has the added advantage of being able to determine whether an anatomic abnormality is functionally significant. Uptake within a pars interarticularis defect confirms the back pain to be due to spondylolysis or spondylolisthesis noted on plain x-ray films; the absence of uptake suggests another cause.

Single-photon-emission computed tomography enhances the interpretation of bony abnormalities of the skull, hips, and knees. It is almost as sensitive as magnetic resonance imaging in showing internal derangement of the temporomandibular joint and can be particularly useful in showing altered joint mechanics before internal derangement has occurred. Decreased uptake within an area of avascular necrosis of the femoral head may be "hidden" on planar imaging by the overlying acetabulum. Being able to "slice" directly through the femoral head has increased the ability to detect avascular necrosis by as much as 30%. An accurate differentiation can be made between chronic knee pain of meniscal, patellar, or degenerative origin.

Postoperatively, SPECT has been used to assess mandibular graft viability and to distinguish postsurgical changes from pseudarthrosis after spinal fusion. It can be used with any bone-seeking radiopharmaceutical agent, as evidenced by the uptake of neutrophils labeled with gallium 67 or indium 111 in inflammatory bone disease.

The procedure is done easily in most nuclear medicine departments in about 45 minutes with no discomfort to the patient. The relative cost is less than for other specialized imaging studies and is less than half that of magnetic resonance in the imaging of both hips for avascular necrosis.

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Single-Photon-Emission Computed Tomography of Cerebral Perfusion

SINGLE-PHOTON-EMISSION computed tomography (SPECT) using cerebral perfusion agent has been added to the list of noninvasive tomographic techniques currently available to evaluate the brain. It is a nuclear imaging method that creates slices of the brain similar in many ways to the images produced by x-ray computed tomography (CT) and magnetic